WHAT IS CLAIMED IS:

1. An optical system for converting a single input beam of light into a plurality of spatially or angularly shifted output beams, each having a different wavelength, said system comprising:

an array of a plurality of acousto-optical and/or stimulated Brillouin scattering (SBS) wavelength-shifting devices in optical communication with each other,

whereby variations in the wavelength of said input beam or in temperature or strain of said devices will cause the wavelengths of said output beams to uniformly vary, thus maintaining constant intra-wavelength spacings between said output beams.

2. The system as claimed in claim 1, further comprising an optical beam splitter or circulator located along the input and output paths of the beams to and from said wavelength-shifting devices, for reflecting said output beams in directions different than the directions of said output paths.

3. The system as claimed in claim 1, further comprising an optical amplifier located along the path of said input beam.

4. The system as claimed in claim 1, wherein at least a part of an output beam from one of said wavelength-shifting devices is utilized as an input beam to another of said devices, forming a cascaded optical system.

5. The optical system as claimed in claim 4, wherein the output of the last of said devices is connected, via a filter, to the input of the first of said devices, and wherein a demultiplexer is connected to the output of at least one of said devices for producing multiple, separated wavelengths.

6. The system as claimed in claim 1, wherein said wavelength-shifting device is composed of a waveguide providing a continuously patterned optical path.

7. The system as claimed in claim 6, wherein said wavelength-shifting device is composed of a wound optical fiber.

8. The system as claimed in claim 7, wherein said fibers have a small core area and are selected from the group comprising photonic bandgap fibers, dispersion compensating fibers, or high numerical aperture fibers.

9. The system as claimed in claim 1, wherein said wavelength-shifting devices are composed of different materials, one of said materials having an increasing refractive index with temperature change, and one having a decreasing refractive index with temperature change.

10. The system as claimed in claim 1, wherein an output beam for a first one of said wavelength-shifting devices constitutes a source for a second one of said devices.

11. The system as claimed in claim 1, further comprising an optical parametric oscillator (OPO) located along the input and/or output paths of at least one of said wavelength-shifting devices.

12. The system as claimed in claim 1, further comprising at least one modulator for modulating at least one of said output beams.

13. The system as claimed in claim 1, wherein said input beam is obtained from a tunable laser.

14. The system as claimed in claim 13, further comprising at least one tunable laser for backup purposes.

15. The system as claimed in claim 1, wherein said input beam is obtained from a fixed-wavelength laser.

16. The system as claimed in claim 1, wherein said input beam is obtained from one of a plurality of laser sources in parallel with each other so that, upon the malfunctioning of one of said sources, at least one of the other sources is utilized.

17. The optical system as claimed in claim 1, wherein said input beam comprises a multi-wavelength cascade created by the difference between two or more cascades of different spacings.

18. An optical system as claimed in claim 1 which includes a feedback line for supplying the output beam of the last of said wavelength-shifting devices to the input of the first of said wavelength-shifting devices concurrently with the supplying of said input beam to said first wavelength-shifting device.

19. An optical system as claimed in claim 1, having at least one additional light source in connection with one or more acousto-optical and/or stimulated Brillouin scattering (SBS) wavelength-shifting devices.

20. An optical demultiplexing system for receiving a beam having a multitude of wavelength channels with known spacing between them and separating said channels into a series of beams having different wavelengths, said system comprising:

an actuator device for tuning the de-multiplexed wavelengths, wherein at least one of said wavelength channels acts as a control loop channel on which a closed control loop for locking the wavelength is activated.

21. The optical demultiplexing system as claimed in claim 20, wherein said multitude of wavelength channels with known spacing are obtained using an array of a plurality of acousto-optical and/or SBS wavelength-shifting devices in optical communication with each other.

22. The optical demultiplexing system as claimed in claim 20, wherein said actuator device is a piezoelectric or magneto-restrictive actuator.

23. The optical demultiplexing system as claimed in claim 20, wherein data of said control loop channel has a specific modulation enabling it to be differentiated from neighboring channels.

24. The optical demultiplexing system as claimed in claim 20, wherein said closed control loop comprises two detectors and the wavelength of said control loop channel is between the two wavelengths detected by said two detectors.

25. The optical demultiplexing system as claimed in claim 20, wherein said actuator device rotates or moves a wavelength-dispersive component such as a grating or a prism.

26. The optical demultiplexing system as claimed in claim 20, wherein said actuator device moves or tilts a fiber array or a waveguide.

27. The optical demultiplexing system as claimed in claim 20, further comprising an acousto-optical wavelength-shifting device, through which said beam is passed.

28. The optical demultiplexer of claim 20 which includes

a grating receiving said light beam and diffracting the multiple wavelengths at different diffraction angles, and

an optical receiver receiving the diffracted multiple wavelengths and transmitting each separate wavelength to a separate output.

29. An optical system for converting an input beam of light into a plurality of output beams having different wavelengths, said system comprising:

an array of a plurality of acousto-optical and/or stimulated Brillouin scattering (SBS) wavelength-shifting devices in optical communication with each other, the first wavelength-shifting device in said array receiving said input beam of light, thereby causing said first wavelength-shifting device to produce a first output beam having a wavelength shifted from that of said input beam, and

each of the remaining wavelength-shifting devices in said array receiving the output beam from the preceding wavelength-shifting device to cause each successive wavelength-shifting device to produce an output beam having a wavelength shifted from the wavelength of the input beam to that device,

whereby variations in the wavelength of said input beam or in temperature or strain of said wavelength-shifting devices will cause the wavelengths of said output beams to vary substantially uniformly, thus maintaining substantially constant intra-wavelength spacings between said output beams.

30. The system of claim 29 which includes an array of splitters each of which is connected to both the input and the output of one of said wavelength-shifting devices, and to the input of the next of said wavelength-shifting devices,

for supplying the first wavelength-shifting device with said input beam, and for supplying each of the other wavelength-shifting devices with the output of the preceding wavelength-shifting device.

31. The system of claim 29 which includes a feedback line for supplying the output beam of the last of said wavelength-shifting devices to the input of the first of said wavelength-shifting devices concurrently with the supplying of said input beam to said first wavelength-shifting device.

32. The system of claim 31 which includes a filter in said feedback line for limiting the wavelength of the output beam of said last wavelength-shifting device that can be fed back to said first wavelength-shifting device, thereby causing the feedback to be resumed with the output beam produced by said last wavelength-shifting device in response to the supply of said input beam to said first wavelength-shifting device.

33. The system of claim 29 which includes a source of seeding light beams for said wavelength-shifting devices.

34. The system of claim 29 wherein each of said wavelength-shifting devices comprises first and second wavelength-shifting components connected in series and having refractive indices that vary in opposite directions in response to temperature changes, whereby wavelength shifts caused by a temperature change in said first and second components substantially cancel each other.

35. The system of claim 29 which includes a separate output line for the output beam produced by each of said wavelength-shifting devices.

36. An optical demultiplexer for demultiplexing a light beam containing multiple wavelengths, said demultiplexer comprising

a grating receiving said light beam and diffracting the multiple wavelengths at different refraction angles, and

an optical receiver receiving the diffracted multiple wavelengths and transmitting each separate wavelength to a separate output.

37. The optical demultiplexer of claim 36 which includes at least one actuator for adjusting the relative positions of said grating and said receiver, at least one sensor for detecting at least one characteristic of the light beam at at least one of said outputs of said receiver and producing a corresponding control signal, and a controller responsive to said control signal for energizing said actuator to adjust the relative positions of said grating and said receiver.

38. The optical demultiplexer of claim 37 which includes a reference signal source producing a reference signal representing a desired control signal, and said controller is responsive to said reference signal for energizing said actuator until said control signal corresponds to said reference signal.

39. The optical demultiplexer of claim 36 wherein

said detector detects at least one characteristic of at least one of the light beams having said diffracted wavelengths, and

said controller adjusts the relative positions of said diffracted wavelengths and said separate optical transmissions lines to optimize at least one characteristic of the light beams having said diffracted wavelengths.

40. The system of claim 37 in which said detector produces a control signal representing said detected characteristic, and which includes

a reference signal source producing a reference signal representing a desired characteristic of the light beams having said diffracted wavelengths, and

means for adjusting the relative positions of said diffracted wavelengths and said separate optical transmissions lines until said control signal corresponds to said reference signal.

41. The system of claim 36 which includes means for producing said light beam containing multiple wavelengths comprising

an array of a plurality of wavelength-shifting devices in optical communication with each other, the first wavelength-shifting device in said array receiving said input beam of light, thereby causing said first wavelength-shifting device to produce a first output beam having a wavelength shifted from that of said input beam, and

each of the remaining wavelength-shifting devices in said array receiving the output beam from the preceding wavelength-shifting devices to cause each successive wavelength-shifting device to produce an output beam having a wavelength shifted from the wavelength of the input beam to that device,

whereby variations in the wavelength of said input beam or in temperature or strain of said devices will cause the wavelengths of said output beams to uniformly vary, thus maintaining constant intra-wavelength spacings among said output beams.

42. An optical system for converting an input beam of light into a plurality of output beams having different wavelengths, said system comprising:

an array of a plurality of wavelength-shifting devices in optical communication with each other, the first wavelength-shifting device in said array receiving said input beam of light, thereby causing said first wavelength-shifting device to produce a first output beam having a wavelength shifted from that of said input beam, and

said first wavelength-shifting device comprising first and second wavelength-shifting components connected in series and having refractive indices

that vary in opposite directions in response to temperature changes, whereby wavelength shifts caused by a temperature change in said first and second components substantially cancel each other.

43. An optical system for converting an input beam of light into a plurality of output beams having different wavelengths, said system comprising:

an array of a plurality of wavelength-shifting devices in optical communication with each other, the first wavelength-shifting device in said array receiving said input beam of light, thereby causing said first wavelength-shifting device to produce a first output beam having a wavelength shifted from that of said input beam, and

a source of a seeding light beam for said wavelength-shifting devices.

44. An optical system for converting an input beam of light into a plurality of output beams having different wavelengths, said system comprising:

an array of a plurality of wavelength-shifting devices in optical communication with each other, the first wavelength-shifting device in said array receiving said input beam of light, thereby causing said first wavelength-shifting device to produce a first output beam having a wavelength shifted from that of said input beam,

each of the remaining wavelength-shifting devices in said array receiving the output beam from the preceding wavelength-shifting device to cause each successive wavelength-shifting device to produce an output beam having a wavelength shifted from the wavelength of the input beam to that device, and

a feedback line for supplying the output beam of the last of said wavelength-shifting devices to the input of the first of said wavelength-shifting devices concurrently with the supplying of said input beam to said first wavelength-shifting device.

45. The system of claim 44 which includes a filter in said feedback line for limiting the wavelength of the output beam of said last wavelength-shifting device that can be fed back to said first wavelength-shifting device, thereby causing the feedback to be resumed with the output beam produced by said last wavelength-shifting device in response to the supply of said input beam to said first wavelength-shifting device.

46. A method of converting an input beam of light into a plurality of spatially or angularly shifted output beams, each having a different wavelength, said method comprising

supplying said input beam of light to the first of a plurality of acousto-optical and/or stimulated Brillouin scattering (SBS) wavelength-shifting devices in optical communication with each other, thereby causing said first wavelength-shifting device to produce a first output beam having a wavelength shifted from that of said input beam, and

supplying the output beam from each of said plurality of wavelength-shifting devices to the next of said plurality of wavelength-shifting devices to cause each successive wavelength-shifting device to produce an output beam having a wavelength shifted from the wavelength of the input beam to that device,

whereby variations in the wavelength of said input beam or in temperature or strain of said devices will cause the wavelengths of said output beams to uniformly vary, thus maintaining constant intra-wavelength spacings among said output beams.

47. The method of claim 46 which includes feeding the output beam of the last of said wavelength-shifting devices back to the input of the first of said wavelength-shifting devices concurrently with the supplying of said input beam to said first wavelength-shifting device.

48. The method of claim 47 which includes limiting the wavelength of the output beam of said last wavelength-shifting device that can be fed back to said first wavelength-shifting device, thereby causing the feedback to be resumed with the output beam produced by said last wavelength-shifting device in response to the supply of said input beam to said first wavelength-shifting device.

49. The method of claim 46 which includes seeding said wavelength-shifting devices with light beams having predetermined characteristics.

50. The method of claim 46 wherein each of said wavelength-shifting devices comprises first and second wavelength-shifting components having refractive indices that vary in opposite directions in response to temperature changes, and supplying the output beam from said first component as the input to said second component so that the output beam from said wavelength-shifting device is the output beam from said second component, whereby wavelength shifts caused by a temperature change in said first and second components substantially cancel each other.

51. The method of claim 46 which includes supplying the output beam produced by each of said wavelength-shifting devices on a separate output line.

52. An optical demultiplexing method for demultiplexing a light beam containing multiple wavelengths, said method comprising

diffracting each of the multiple wavelengths at different refraction angles, and

coupling each of the diffracted wavelengths to a separate optical transmission line.

53. The method of claim 52 wherein which includes

detecting at least one characteristic of at least one of the light beams having said diffracted wavelengths, and

adjusting the relative positions of said diffracted wavelengths and said separate optical transmissions lines to optimize at least one characteristic of the light beams having said diffracted wavelengths.

54. The method of claim 53 which includes

producing a reference signal representing a desired characteristic of the light beams having said diffracted wavelengths,

producing a control signal representing said detected characteristic, and

adjusting the relative positions of said diffracted wavelengths and said separate optical transmissions lines until said control signal corresponds to said reference signal.

55. The method of claim 52 wherein said light beam containing multiple wavelengths is produced by

supplying an input beam of light to the first of a plurality of wavelength-shifting devices in optical communication with each other, thereby causing said first wavelength-shifting device to produce a first output beam having a wavelength shifted from that of said input beam, and

supplying the output beam from each of said plurality of wavelength-shifting devices to the next of said plurality of wavelength-shifting devices to cause each successive wavelength-shifting device to produce an output beam having a wavelength shifted from the wavelength of the input beam to that device,

whereby variations in the wavelength of said input beam or in temperature or strain of said devices will cause the wavelengths of said output beams to uniformly vary, thus maintaining constant intra-wavelength spacings among said output beams.

56. A method of converting an input beam of light into a plurality of output beams having different wavelengths, said method comprising:

supplying said input beam of light to the first of a plurality of wavelength-shifting devices in optical communication with each other, the first wavelength-shifting device in said array receiving said input beam of light, thereby causing said first wavelength-shifting device to produce a first output beam having a wavelength shifted from that of said input beam, said wavelength-shifting device including first and second wavelength-shifting components having refractive indices that vary in opposite directions in response to temperature changes, and

supplying the output beam from said first component as the input to said second component so that the output beam from said wavelength-shifting device is the output beam from said second component, whereby wavelength shifts caused by a temperature change in said first and second components substantially cancel each other.

57. A method of converting an input beam of light into a plurality of output beams having different wavelengths, said method comprising:

supplying said input beam of light to the first of a plurality of wavelength-shifting devices in optical communication with each other, thereby causing said first wavelength-shifting device to produce a first output beam having a wavelength shifted from that of said input beam, and

seeding said wavelength-shifting device with a light beam having predetermined characteristics.

58. The method of claim 57 which includes

supplying the output beam from each of said plurality of wavelength-shifting devices to the next of said plurality of wavelength-shifting devices to

cause each successive wavelength-shifting device to produce an output beam having a wavelength shifted from the wavelength of the input beam to that device,

whereby variations in the wavelength of said input beam or in temperature or strain of said devices will cause the wavelengths of said output beams to uniformly vary, thus maintaining constant intra-wavelength spacings among said output beams.

59. A method of converting an input beam of light into a plurality of output beams having different wavelengths, said method comprising:

supplying said input beam of light to the first of a plurality of wavelength-shifting devices in optical communication with each other, thereby causing said first wavelength-shifting device to produce a first output beam having a wavelength shifted from that of said input beam,

supplying the output beam from each of said plurality of wavelength-shifting devices to the next of said plurality of wavelength-shifting devices to cause each successive wavelength-shifting device to produce an output beam having a wavelength shifted from the wavelength of the input beam to that device, and

supplying the output beam of the last of said wavelength-shifting devices to the input of the first of said wavelength-shifting devices concurrently with the supplying of said input beam to said first wavelength-shifting device,

whereby variations in the wavelength of said input beam or in temperature or strain of said devices will cause the wavelengths of said output beams to uniformly vary, thus maintaining constant intra-wavelength spacings among said output beams.

60. The method of claim 59 which includes limiting the wavelength of the output beam of said last wavelength-shifting device that can be fed back to said first wavelength-shifting device, thereby causing the feedback to be resumed

with the output beam produced by said last wavelength-shifting device in response to the supply of said input beam to said first wavelength-shifting device.

61. An optical system for converting an input beam of light into a plurality of output beams having different wavelengths, said system comprising:

a single laser source producing an input beam of light,

an array of a plurality of wavelength-shifting devices in optical communication with each other, the first wavelength-shifting device in said array receiving said input beam of light produced by said single laser source, thereby causing said first wavelength-shifting device to produce a first output beam having a wavelength shifted from that of said input beam, and

each of the remaining wavelength-shifting devices in said array receiving the output beam from the preceding wavelength-shifting device to cause each successive wavelength-shifting device to produce an output beam having a wavelength shifted from the wavelength of the input beam to that device,

whereby variations in the wavelength of said input beam from said single laser source or in temperature or strain of said wavelength-shifting devices will cause the wavelengths of said output beams to vary substantially uniformly, thus maintaining substantially constant intra-wavelength spacings between said output beams.

62. The optical system of claim 61 which includes optical amplifiers for amplifying the input beams to at least some of said wavelength-shifting devices.